

Chapter 1

Computer Components

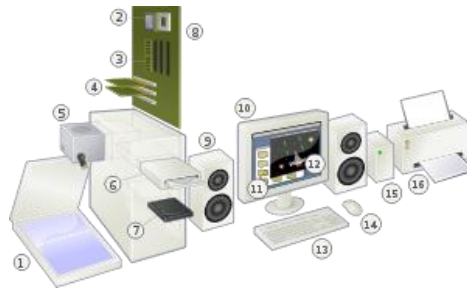
Lesson

A **personal computer (PC)** is any general-purpose computer whose size, capabilities, and original sales price make it useful for individuals, and which is intended to be operated directly by an end-user with no intervening computer operator.

Software applications for personal computers include, but are not limited to, word processing, spreadsheets, databases, Web browsers and e-mail clients, digital media playback, games, and myriad personal productivity and special-purpose software applications. Modern personal computers often have connections to the Internet, allowing access to the World Wide Web and a wide range of other resources. Personal computers may be connected to a local area network (LAN), either by a cable or a wireless connection. A personal computer may be a desktop computer or a laptop, tablet, or a handheld PC.

The 'Post-PC Era', in which the desktop form factor was being replaced with more portable computing such as netbooks, notebooks, tablets, and smartphones.

Hardware



An exploded view of a modern personal computer and peripherals:

1. Scanner
2. CPU (Microprocessor)
3. Primary storage (RAM)
4. Expansion cards (graphics cards, etc.)
5. Power supply
6. Optical disc drive
7. Secondary storage (Hard disk)
8. Motherboard
9. Speakers
10. Monitor
11. System software
12. Application software
13. Keyboard
14. Mouse
15. External hard disk
16. Printer

A typical desktop computer consists of a computer case which holds the power supply, motherboard, hard disk and often an optical disc drive. External devices such as a computer monitor or visual display unit, keyboard, and a pointing device are usually found in a personal computer.

The motherboard connects all processor, memory and peripheral devices together. The RAM, graphics card and processor are mounted directly onto the motherboard. The central processing unit microprocessor chip plugs into a socket. Expansion memory plugs into memory sockets. Some motherboards have the video display adapter, sound and other peripherals integrated onto the motherboard. Others use expansion slots for graphics cards, network cards, or other I/O devices. Disk drives for mass storage are connected to the mother board with a cable, and to the power supply through another cable. Usually disk drives are mounted in the same case as the motherboard; formerly, expansion chassis were made for additional disk storage.

The graphics and sound card can have a break out box to keep the analog parts away from the electromagnetic radiation inside the computer case. For really large amounts of data, a tape drive can be used or (extra) hard disks can be put together in an external case.

The keyboard and the mouse are external devices plugged into the computer through connectors on an I/O panel on the back of the computer. The monitor is also connected to the I/O panel, either through an onboard port on the motherboard, or a port on the graphics card.

The hardware capabilities of personal computers can sometimes be extended by the addition of expansion cards connected via an expansion bus. Some standard peripheral buses often used for adding expansion cards in personal computers as of 2005 are PCI, AGP (a high-speed PCI bus dedicated to graphics adapters), and PCI Express. Most personal computers as of 2005 have multiple physical PCI expansion slots. Many also include an AGP bus and expansion slot or a PCI Express bus and one or more expansion slots, but few PCs contain both buses.

Computer case



A stripped ATX case lying on its side.

A computer case is the enclosure that contains the main components of a computer. Cases are usually constructed from steel or aluminum. Cases can come in many different sizes, or *form factors*. The size and shape of a computer case is usually determined by the form factor of the motherboard that it is designed to accommodate, since this is the largest and most central component of most computers.

Power supply unit



Computer power supply unit with top cover removed.

The power supply unit converts general purpose electric current from the mains to direct current for the other components of the computer.

Processor



AMD Athlon 64 X2 CPU.

The **central processing unit**, or **CPU**, is that part of a computer which executes software program instructions. In older computers this circuitry was formerly on several printed circuit boards, but in PCs is a single integrated circuit. Nearly all PCs contain a type of CPU known as a microprocessor. The microprocessor often plugs into the motherboard using one of many different types of sockets.

Motherboard



A motherboard

The **motherboard**, also referred to as systemboard or mainboard, is the primary circuit board within a personal computer. Many other components connect directly or indirectly to the motherboard. Motherboards usually contain one or more CPUs, supporting circuitry - usually integrated circuits (ICs) - providing the interface between the CPU memory and input/output peripheral circuits, main memory, and facilities for initial setup of the computer immediately after power-on (often called boot firmware or, in IBM PC compatible computers, a BIOS). In many portable and embedded personal computers, the motherboard houses nearly all of the PC's core components. Often a motherboard will also contain one or more peripheral buses and physical connectors for expansion purposes. Sometimes a secondary daughter board is connected to the motherboard to provide further expandability or to satisfy space constraints.

Main memory



1GB DDR SDRAM PC-3200 module

A PC's main memory is fast storage that is directly accessible by the CPU, and is used to store the currently executing program and immediately needed data. PCs use semiconductor **random access memory (RAM)** of various kinds such as DRAM, SDRAM or SRAM as their primary storage. Which exact kind depends on cost/performance issues at any particular time. Main memory is much faster than mass storage devices like hard disks or optical discs, but is usually volatile, meaning it does not retain its contents (instructions or data) in the absence of power, and is much more expensive for a given capacity than is most mass storage. Main memory is generally not suitable for long-term or archival data storage.

Hard disk



A Western Digital 250 GB hard disk drive.

Mass storage devices store programs and data even when the power is off; they do require power to perform read and write functions during usage. Although flash memory has dropped in cost, the prevailing form of mass storage in personal computers is still the hard disk. The disk drives use a sealed head/disk assembly (HDA) which was first introduced by IBM's "Winchester" disk system. The use of a sealed assembly allowed the use of positive air pressure to drive out particles from the surface of the disk, which improves reliability.

Video card



ATI Radeon video card

The **video card** - otherwise called a graphics card, graphics adapter or video adapter - processes and renders the graphics output from the computer to the computer display, and is an essential part of the modern computer. On older models, and today on budget models, graphics circuitry tended to be integrated with the motherboard but, for modern flexible machines, they are supplied in PCI, AGP, or PCI Express format.

Visual display unit



A flat-panel LCD monitor.

A visual display unit (or **monitor**) is a piece of electrical equipment, usually separate from the computer case, which displays viewable images generated by a computer without producing a permanent record. The word "monitor" is used in other contexts; in particular in television broadcasting, where a television picture is displayed to a high standard on a broadcast reference monitor. A computer display device is usually either a cathode ray tube or some form of flat panel such as a TFT LCD. The monitor comprises the display device, circuitry to generate a picture from electronic signals sent by the computer, and an enclosure or case. Within the computer, either as an integral part or a plugged-in Expansion card, there is circuitry to convert internal data to a format compatible with a monitor. The images from monitors originally contained only text, but as Graphical user interfaces emerged and became common, they began to display more images and multimedia content.

Keyboard



A computer keyboard

In computing, a keyboard is an arrangement of buttons that each correspond to a function, letter, or number. They are the primary devices of inputting text. In most cases, they contain an array of keys specifically organized with the corresponding letters, numbers, and functions printed or engraved on the button. They are generally designed around an operators language, and many different versions for different languages exist. In English, the most common layout is the QWERTY layout, which was originally used in typewriters. They have evolved over time, and have been modified for use in computers with the addition of function keys, number keys, arrow keys, and OS specific keys. Often, specific functions can be achieved by pressing multiple keys at once or in succession, such as inputting characters with accents or opening a task manager. Programs use keyboard shortcuts very differently and all use different keyboard shortcuts for different program specific operations, such as refreshing a web page in a web browser or selecting all text in a word processor.

Mouse



Computer mice built between 1986 and 2007

A Mouse on a computer is a small, slideable device that users hold and slide around to point at, click on, and sometimes drag objects on screen in a graphical user interface using a pointer on screen. Almost all Personal Computers have mice. It may be plugged into a computer's rear mouse socket, or as a USB device, or, more recently, may be connected wirelessly via a USB antenna or Bluetooth antenna. In the past, they had a single button that users could press down on the device to "click" on whatever the pointer on the screen was hovering over. Now, however, many Mice have two or three buttons(possibly *more*); a "right click" function button on the mouse, which performs a secondary action on a selected object, and a scroll wheel, which users can rotate using their fingers to "scroll" up or down. The scroll wheel can also be pressed down, and therefore be used as a third button. Some mouse wheels may be *tilted* from side to side to allow sideways scrolling. Different programs make use of these functions differently, and may scroll horizontally by default with the scroll wheel, open different menus with different buttons, among others. These functions may be user defined through software utilities.

Mice traditionally detected movement and communicated with the computer with an internal "mouse ball"; and used optical encoders to detect rotation of the ball and tell the computer where the mouse has moved. However, these systems were subject to low durability, accuracy and required internal cleaning. Modern mice use optical technology to directly trace movement of the surface under the mouse and are much more accurate, durable and almost maintenance free. They work on a wider variety of surfaces and can even operate on walls, ceilings or other non-horizontal surfaces.

Other components

Mass storage

All computers require either fixed or removable storage for their operating system, programs and user generated material.

Formerly the 5¼ inch and 3½ inch floppy drive were the principal forms of removable storage for backup of user files and distribution of software.

As memory sizes increased, the capacity of the floppy did not keep pace; the Zip drive and other higher-capacity removable media were introduced but never became as prevalent as the floppy drive.

By the late 1990s the optical drive, in CD and later DVD and Blu-ray Disc, became the main method for software distribution, and writeable media provided backup and file interchange. Floppy drives have become uncommon in desktop personal computers since about 2000, and were dropped from many laptop systems even earlier.

Early home computers used compact audio cassettes for file storage; these were at the time a very low cost storage solution, but were displaced by floppy disk drives when manufacturing costs dropped, by the mid 1980s.

A second generation of tape recorders was provided when Videocassette recorders were pressed into service as backup media for larger disk drives. All these systems were less reliable and slower than purpose-built magnetic tape drives. Such tape drives were uncommon in consumer-type personal computers but were a necessity in business or industrial use.

Interchange of data such as photographs from digital cameras is greatly expedited by installation of a card reader, which often is compatible with several forms of flash memory. It is usually faster and more convenient to move large amounts of data by removing the card from the mobile device, instead of communicating with the mobile device through a USB interface.

A USB flash drive today performs much of the data transfer and backup functions formerly done with floppy drives, Zip disks and other devices. Main-stream current operating systems for personal computers provide standard support for flash drives, allowing interchange even between computers using different processors and operating systems. The compact size and lack of moving parts or dirt-sensitive media, combined with low cost for high capacity, have made flash drives a popular and useful accessory for any personal computer user.

The operating system (e.g.: Microsoft Windows, Mac OS, Linux or many others) can be located on any storage, but typically it is on a hard disks. A Live CD is the running of a OS directly from a CD. While this is slow compared to storing the OS on a hard drive, it is typically used for installation of operating systems, demonstrations, system recovery, or other special purposes. Large flash memory is currently more expensive than hard drives of similar size (as of mid-2008) but are starting to appear in laptop computers because of their low weight, small size and low power requirements.

Computer communications

- Internal modem card
- Modem
- Network adapter card
- Router

Software

Computer software is a general term used to describe a collection of computer programs, procedures and documentation that perform some tasks on a computer system. The term includes application software such as word processors which perform productive tasks for users, system software such as operating systems, which interface with hardware to provide the necessary services for application software, and middleware which controls and co-ordinates distributed systems.

Software applications for word processing, Internet browsing, Internet faxing, e-mail and other digital messaging, multimedia playback, computer game play and computer programming are common. The user of a modern personal computer may have significant knowledge of the operating environment and application programs, but is not necessarily interested in programming nor even able to write programs for the computer. Therefore, most software written primarily for personal computers tends to be designed with simplicity of use, or "user-friendliness" in mind. However, the software industry continuously provide a wide range of new products for use in personal computers, targeted at both the expert and the non-expert user.

Operating system

An operating system (OS) manages computer resources and provides programmers with an interface used to access those resources. An operating system processes system data and user input, and responds by allocating and managing tasks and internal system resources as a service to users and programs of the system. An operating system performs basic tasks such as controlling and allocating memory, prioritizing system requests, controlling input and output devices, facilitating computer networking and managing files.

Common contemporary desktop OSs are Microsoft Windows, Mac OS X, Linux, Solaris and FreeBSD. Windows, Mac, and Linux all have server and personal variants.

Microsoft Windows

Microsoft Windows is the collective brand name of several software operating systems by Microsoft. Microsoft first introduced an operating environment named *Windows* in November 1985 as an add-on to MS-DOS in response to the growing interest in graphical user interfaces (GUIs) generated by Apple's 1984 introduction of the Macintosh. The most recent client version of Windows is Windows 7 and Windows Server 2008 R2 which was available at retail on October 22, 2009.

OS X

OS X (formerly Mac OS X) is a line of operating systems developed, marketed, and sold by Apple Inc.. OS X is the successor to the original Mac OS, which had been Apple's primary operating system since 1984. OS X is a Unix-based graphical operating system. The most recent version of OS X is OS X Lion.

AmigaOS

AmigaOS is the default native operating system of the Amiga personal computer. It was developed first by Commodore International, and initially introduced in 1985 with the Amiga 1000. Early versions (1.0-3.9) run on the Motorola 68k series of 16-bit and 32-bit microprocessors, while the newer AmigaOS 4 runs only on PowerPC microprocessors.

Linux



A Linux distribution running KDE Plasma Desktop.

Linux is a family of Unix-like computer operating systems. Linux is one of the most prominent examples of free software and open source development: typically all underlying source code can be freely modified, used, and redistributed by anyone. The name "Linux" comes from the Linux kernel, started in 1991 by Linus Torvalds. The system's utilities and libraries usually come from the GNU operating system, announced in 1983 by Richard Stallman. The GNU contribution is the basis for the alternative name GNU/Linux.

Applications

A computer user will apply application software to carry out a specific task. System software supports applications and provides common services such as memory management, network connectivity, or device drivers; all of which may be used by applications but which are not directly of interest to the end user. A simple, if imperfect analogy in the world of hardware would be the relationship of an electric light bulb (an application) to an electric power generation plant (a system). The power plant merely generates electricity, not itself of any real use until harnessed to an application like the electric light that performs a service that benefits the user.

Typical examples of software applications are word processors, spreadsheets, and media players. Multiple applications bundled together as a package are sometimes referred to as an *application suite*.